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## LVII.—*Report on the Echinodermata collected during the Arctic Expedition*, 1875–6.


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[The Echinodermata collected in Smith's Sound and at the winter quarters of H.M.SS. 'Alert' and 'Discovery' were obtained by the naturalists of the expedition, Capt. Feilden, R.A., and Mr. Hart, under the superintendence of Capt. Sir George Nares, R.N., F.R.S., under no small difficulty. Apart from the trouble of dredging when the tangles froze on coming out of the sea, the proceeding could not be frequently attempted; yet the number of specimens collected was considerable. The collection, consisting of specimens admirably cleaned and preserved in spirit, and of others equally well taken care of in the dry state, was sent to the British Museum. Dr. Günther confided it to me for description and classification; and after I had determined the species, I asked Mr. Percy Sladen, F.L.S., F.G.S., to examine the forms independently and to join me in drawing up this report. Our results were nearly the same; but to my colleague is due the new species of *Asteracanthion*. Dr. Carpenter was good enough to examine and determine the two species of *Comatula*. I am very glad to have this opportunity of thanking Capt. Feilden for his assistance in giving information regarding the depth, temperatures, and localities relating to the specimens.

The collection is so interesting and the specimens are so

variable, that we propose to describe it fully in a separate monograph.—P. Martin Duncan.]

*Localities.* To avoid repetition, the following are the positions of the collecting-stations in Grinnell Land mentioned in this report:—

Floeberg Beach (the winter quarters of H.M.S. 'Alert'), lat. 82° 27′ N., long. 61° 42′ W.

Discovery Bay (the winter quarters of H.M.S. 'Discovery'), lat. 81° 41′ N., long. 64° 45′ W.

Richardson Bay, lat. 80° 5′ N.

Cape Fraser, lat. 79° 44′ N.

Hayes Point, lat. 79° 42′ N.

Dobbin Bay, lat. 79° 40′ N.

Cape Louis Napoleon, lat. 79° 38′ N.

Franklin-Pierce Bay, lat. 79° 25′ N.

*Synonymy.* It has not been the intention in the following citations to supply a complete list of all the different authorities by whom the various determinations have been maintained, but simply to give such references as will be found sufficient to indicate the history or title-warrant of the nomenclature employed. It is hoped that the method of "authorization" which is here adopted will serve not only as an "index of registration," but likewise accord acknowledgment to the original describer—the name of the latter being enclosed within parenthesis, and followed by that of the naturalist who first used the combination as here given.

Although the present report is chiefly confined to a description of the Echinoderms obtained north of lat. 78° N., it has been thought desirable and interesting to include the record of a dredging made by Captain Feilden during the outward voyage, on July 2, 1875, in lat. 65° N. The station was 26 miles from the Greenland coast, and the depth 30 fathoms; bottom rocky, with rounded pebbles. The following Asteroids and Ophiurans were taken here:—*Asteracanthion polaris*, M. & T.; *Solaster endeca* (Linn.), Forbes; *Ophioglypha robusta* (Ayr.), Lym.; *Ophioglypha Stuwitzii* (Lütk.), Lym.; *Ophiopholis bellis* (Linck), Lym.

## *List of the Echinoderms collected during the Arctic Expedition of* 1875–76.

### Holothurioidea.

Cucumaria frondosa (*Gunn.*), *Forbes.*

### Echinoidea.

Strongylocentrotus dröbachiensis (*O. F. M.*), *A. Ag.*

ASTEROIDEA.

Asteracanthion grœnlandicus, *Stp.*
—— polaris, *M. & T.*
—— palæocrystallus, *nobis.*
Stichaster albulus (*Stimps.*), *Verrill.*
Crossaster papposus (*Linck*), *M. & T.*
Solaster endeca (*Linn.*), *Forbes.*
—— furcifer, *v. Düb. & Kor.*
Pteraster militaris (*O. F. M.*), *M. & T.*

OPHIUROIDEA.

Ophioglypha Sarsii (*Lütk.*), *Lym.*
—— robusta (*Ayr.*), *Lym.*
—— Stuwitzii (*Lütk.*), *Lym.*
Ophiocten sericeum (*Forb.*), *Ljungm.*
Ophiopholis bellis (*Linck*), *Lym.*
Amphiura Holbölli, *Lütk.*
Ophiacantha spinulosa, *M. & T.*
Astrophyton arcticum (*Leach*).

CRINOIDEA.

Antedon Eschrichtii (*Müll.*).
—— celtica, *Barrett.*

## HOLOTHUROIDEA.

### *Cucumaria frondosa* (Gunner.), Forbes.

*Holothuria frondosa*, Gunnerus, Act. Holm. 1767, p. 115, tab. iv. f. 1–2.
*H. pentactes*, O. F. Müller, Zool. Dan. vol. iii. p. 54, vol. iv. p. 3; Fabricius, Fauna Grönl.; Zool. Samlinger, 2 Heft, no. 249, p. 249.
*H. grandis*, Forbes & Goodsir, Athenæum, no. 618.
*Pentacta frondosa*, Jäger, de Holoth. p. 12; Stimpson, Syn. Marine Invert. Grand Manan, p. 16.
*Cucumaria frondosa*, Forbes, Hist. Brit. Starfishes, p. 209; v. Düben & Koren, K. Vet.-Akad. Handl. 1844, p. 293.
*C. fucicola*, Forbes & Goodsir, Athenæum, no. 618; Forbes, Hist. Brit. Starfishes, p. 227; in Append. Dr. Sutherland's Journ. of Penny's Voyage.
*Botryodactyla grandis*, Ayres, Proc. Boston Soc. Nat. Hist. 1854, vol. iv. p. 52.

Coll. Feilden: Baffin's Bay.

A *Cucumaria* with smooth tough body, of subpentagonal ovate form. Ambulacral suckers arranged in five longitudinal series, each being a double row, with the tube feet alternating. Suckers capable of entire retraction. Tentacles ten, pedunculate, frondose, all of equal size.

This Holothurian has a very extensive geographical distribution, being chronicled by Forbes, under the name of *C.*

*fucicola*, from Assistance Bay (Capt. Penny's voyage), and by Stimpson from Grand Manan in the Bay of Fundy. It is found also on the coast of Massachusetts, Gulf of Georgia (Salenka), San Francisco (Ayres), along the whole Scandinavian coast, Iceland, Færöe Islands, and in the English Channel.

*C. frondosa* attains great dimensions, the present individual (one specimen only was obtained) being but small; its length is 80 millims., and diameter about 50 millims.

## Echinoidea.

### *Strongylocentrotus dröbachiensis* (Müller), A. Ag.

*Echinus dröbachiensis*, O. F. Müller, Zool. Dan. Prodr. p. 235.
*E. sexatilis*, Fabricius, Fauna Grönl. p. 368 (non Müller).
*E. neglectus*, Lamarck, An. s. Vert. iii. p. 49.
*E. subangularis*, Fleming, Brit. An. p. 479 (non Leske).
*E. granularis*, Say, Journ. A. N. S. Philad. v. p. 225 (non Lamarck).
*E. granulatus*, Gould, Rep. Inv. Mass.
*Strongylocentrotus chlorocentrotus*, Brandt, Prodr. p. 264.
*Toxopneustes dröbachiensis*, Agassiz, Cat. rais., Ann. Sc. N..vi. p. 367.
*T. neglectus*, id. ibid.
*T. granulatus*, id. ibid.
*T. Dübenii*, id. ibid.
*Echinometra dröbachiensis*, Gray, Brit. Rad. p. 4.
*Echinus chloroticus*, Stimpson, Crust. & Echin. Pacif. Sh. p. 86.
*Euryechinus dröbachiensis*, Verrill, Proc. Bost. Soc. Nat. Hist. x. pp. 341, 352.
*E. granulatus*, Verrill, Proc. Boston Soc. Nat. Hist. x. pp. 340, 352.
*Toxopneustes carnosus*, Barn. in Agassiz, Proc. A. N. S. Philad. 1863, p. 357.
*T. pictus*, Norman, Dredg. Rep. Hebr. p. 314.
*T. pallidus*, Sars, Nye Echin., Vid. Selsk. Forh. 1871.
*Strongylocentrotus dröbachiensis*, A. Agassiz, Rev. Echini, pp. 162, 277.

Coll. Feilden: Richardson Bay, 70 fms. (young); Franklin-Pierce Bay, 15 fms., bottom-temperature 29°·5 F.; Cape Napoleon; Hayes Point, 35 fms., bottom-temperature 29°·5 F.

Coll. Hart: Discovery Bay, 15–20 fms., muddy bottom; Franklin-Pierce Bay, 13–15 fms., stony.

Owing to the extensive range of this boreal echinoid, the variations to which it is subject are so great that there are perhaps few other species which include in their synonymy so large a number of modern determinations. Distant observers, depending upon the stability of "local forms," have founded numerous so-called new species, all of which have hitherto, however, proved untenable when due comparison has come to be made with a large series of specimens.

The northern varieties, known as *S. granulatus* (Say), Gould, and *S. chlorocentrotus*, Brandt, fail to present any

characters of sufficient importance to warrant their separation from the *dröbachiensis* group, although when isolated and extreme examples are compared the differences at first sight appear very marked.

Similarly with the specimens collected by the recent expedition, separate individuals placed by the side of a single *S. dröbachiensis* from a more southern habitat present superficially a striking divergence.

Of these arctic forms the test is depressed, the spines of the abactinal surface so small (merely miliaries) and so widely spaced that the echinus has quite a naked appearance. The pores are arranged in arcs of 5–6. The primary tubercles are large, only one to each plate, and form prominent vertical rows. The scrobicular areas are wide and bounded by an irregular circlet of tubercles little larger than miliaries; and there are but few other tubercles in addition to these on the plates above the ambitus. Extending from the actinostome to the ambitus there is a moderate-sized secondary tubercle on each side of the primary.

All the specimens present the appearance of stunted growth.

The colour of the test is a varying shade of purplish brown, and that of the spines greenish grey.

On some examples the pedicellariæ are remarkably numerous, especially the large tridactyle form on the abactinal surface.

Good series of specimens were obtained at several stations, and in general facies present great constancy of character.

The largest individual (from Cape Napoleon) measures 43 millims. in diameter, 21 millims. in height, and has twenty primary interambulacral tubercles.

## Asteroidea.

### *Asteracanthion grönlandicus*, Steenstrup.

? *Uraster violaceus*, Forbes (pars) (non Müller), Sutherland's Journ. Append.

*Asteracanthion Mülleri*, Sars?, var., Steenstrup, Vid. Meddel. 1854, p. 240.

*A. Mülleri*, Stimpson, Invert. Grand Manan.

*A. grönlandicus*, Steenstrup, Vidensk. Meddel. 1854, p. 240; Lütken, Vid. Meddel. 1857, p. 29.

Coll. Feilden: Discovery Bay, 25 fms.; Cape Fraser, 80 fms.; Hayes Point, 25 fms.; Franklin-Pierce Bay, 15 fms.

Coll. Hart: Franklin-Pierce Bay, 13–15 fms., stony.

This is a small starfish, with five moderately thick arms. Proportion of disk-radius to arm-radius 1 : 4·5 or 5. Ambu-

lacral spines rather long and cylindrical, arranged (in very irregular alternation) two and one to each plate. The double spines radiate in opposite directions, the single ones standing vertical to the floor of the furrow. Except in young individuals, and near the tip of the arm, the double series are the most numerous, being generally borne by two or three plates in succession. After these follow two or three (according to age) longitudinal series of separate spines, not quite so long as the ambulacral spines, and tapering slightly at their tips. The middle series, when present, are smaller than the others, and placed midway upon the lateral imbricating pieces. At the base of each of the spines of these three series is a circlet of pedicellariæ. The ossicles and interspaces of the calcareous network on the abactinal surface of the rays present a very transversely elongate arrangement, in consequence of which the spinelets springing from the imbricating pieces assume the character (though irregularly) of a transverse position across the arm. The dorsal spinelets, which are much finer and shorter than the ventro-lateral series, are arranged in groups upon the ossicles, and in specimens preserved in spirit are more than half-covered by the thick corrugated skin which invests the body. The pedicellariæ are, as a rule, not very numerous upon the dorsal surface. The papulæ are single. Upon the disk the spinelets are more closely placed; and this, in spirit-examples, gives quite a distinct appearance to that portion of the animal, whilst in some specimens the disk-spinelets are rather longer than those which are found upon the rays.

Dr. Lütken is of opinion that this is the species cited by Forbes under the name of *Uraster violaceus*, from Assistance Bay (Capt. Penny's Expedition) *. It seems probable to us, also, that the *Asterias violacea*, in Sabine's Report on Parry's second voyage, is likewise *A. grönlandicus*, since the *Asterias rubens*, Fab. (non Linné), also there mentioned, is referable to *A. polaris*, M. & T.

*Asteracanthion polaris*, Müller and Troschel.

*Asterias rubens*, Fabricius (non Linné), Fauna Grönl. p. 369.
*A. minuta*, Fabricius, =*A. polaris* juv. (*teste* Lütken).
? *A. rubens*, Sabine in Suppl. Parry's Voyage, &c.
? *A. ochotense*, Brandt, Rec. Act. Acad. St. Petersb. 1834, p. 269.
*Asteracanthion polaris*, Müller & Troschel, Syst. d. Asteriden, p. 16.

Some large specimens were taken on the Torske Bank, Greenland, on the outward journey; and several young exam-

* Vidensk. Meddel. 1857, Overs. Grönl. Echin. p. 29.

ples occurred in Capt. Feilden's dredging in lat. 65° N., 26 miles from the Greenland coast, at a depth of 30 fathoms.

*Asteracanthion palæocrystallus*, n. sp.

In general appearance this starfish bears a strong resemblance to a *Cribrella*, the rays, five in number, being round and tumid; they are long and taper considerably towards the point. The disk is small, its diameter being proportional to that of the rays as 1 : 5·5. Skin semitransparent, not corrugated, and investing thickly every appendage of the body. Ambulacral pores well-spaced, forming two simple rows of sucker-feet, as in *Stichaster*. Each interambulacral plate bears two very slender spines, which form two regular rows, one radiating towards the furrow, the other to the margin. The spines upon the sides of the arms are much shorter than the ambulacral spines, and comparatively more robust, and are the same in size and character as the spinelets of the dorsal surface. The ossicles of the abactinal network are arranged more quadrilaterally than is usual in *Asteracanthion*; a regular median line passes down each ray, the others running parallel and transverse to this with more or less regularity. Only a single spinelet is given off at each decussation, with an additional one, frequently, on the imbricating ossicle; the spinelets are consequently widely spaced and assume (although somewhat irregularly) a fairly rectilineal arrangement. The spinelets are of the same shape and structure as in *Stichaster*; they are deeply grooved, and have 3–5 denticles proceeding from their truncate and slightly radiate apex. The ambulacral spines have the shafts also denticulate. The pedicellariæ ("croisés," Perrier) are more numerous upon the dorsal surface than the spinelets, amongst which they are placed separately and at intervals apart. These pedicellariæ are large and closely resemble those of *Stichaster*, the fore part of the "jaw" being very gibbous and truncate. The pedicellariæ together with the dorsal spinelets, which are but little longer, are covered with a thick investing membrane, which, in spirit preparations, gives quite a papillate appearance to the starfish.

Upon the disk the spines are somewhat more crowded than upon the rays; and the "eye"-spines at the tip of the rays form a robust terminal fringe. The madreporiform plate is obscure; and of the large simple pedicellariæ there are but very few.

Although this species resembles *Stichaster* in so many respects, the arrangement of the dorsal ossicles is hardly such as would include it within that genus. *A. palæocrystallus*

may fairly, however, be regarded as a connecting link between *Asteracanthion* and *Stichaster*.

From the character of the ambulacral spines, the absence of papulæ, and the obscurity of the madreporiform body, we are disposed to regard even the largest specimen we have as being not yet fully developed: it measures 30 millims. in its greatest diameter, and 5·5 millims. across the disk, and was collected by Capt. Feilden in Discovery Bay. Depth 25 fathoms, hard bottom. Another individual from Cape Fraser (80 fathoms) is only 10 millims. in greatest diameter, yet presents all the characters of the larger specimen.

### *Stichaster albulus* (Stimps.), Verrill.

*Asteracanthion albulus*, Stimpson, Invert. Grand Manan, p. 14.
*A. problema*, Steenstrup, Vid. Meddel. 1854, p. 240; Lütken, Vid. Meddel. 1857, p. 30.
*Stichaster albulus*, Verrill, Proc. Boston Soc. Nat. Hist. vol. x.

Coll. Feilden: Franklin-Pierce Bay, 15 fathoms; Proven, 13 fathoms.

A little starfish with small disk and rounded or somewhat arched rays, the number of which is almost invariably six, three rays on one side being, as a rule, very much shorter than those on the other. Proportion of the diameter of the disk to that of the arms 1 : 5 or rather more. The ambulacral furrows are wide, with suckers arranged in two simple rows. On each interambulacral plate are two "ambulacral" spines radiating slightly to the right and left. Closely succeeding to those on the sides of the arms follow a series of three similar spines, but not always a series opposite to each interambulacral plate, owing to the imbricating pieces being more widely spaced. The dorsal ossicles present a regular rectangular arrangement; and the interspaces, which are very small and are occupied by a single papula, form, in consequence, regular longitudinal and transverse rectilineal series. From each intersection springs a small subquadrate group of from three to five short dorsal spines, amongst which are placed one or two pedicellariæ. Towards the sides the pedicellariæ are more numerous. The spine groups are regularly disposed in longitudinal and transverse lines, those of the middle row being more densely packed than the others, thereby forming a more or less distinct median line down each ray. The spinelets are of equal length, and, being closely set, give a smooth velvety appearance to the starfish. From the apices of the spinelets, which are broader than the bases, proceed three or four small denticles.

Only three specimens of this *Stichaster* were obtained in

Franklin-Pierce Bay, and were quite young individuals, the largest measuring 16 millims. in its largest diameter. A much finer example was dredged at Proven on the outward journey, in which the diameters of rays and disk were respectively 30 millims. and 6 millims.

*Crossaster papposus* (Linck), Müller and Troschel*.

*Triskaidecactis papposa*, Linck, De Stellis marinis, p. 43.
*Asterias helianthoides*, Pennant, Brit. Zool. iv. p. 66. no. 72.
*A. papposa*, Fabricius, Fauna Grönlandica, p. 369.
*A. affinis*, Brandt, Act. Acad. St. Petersb. 1834, p. 272.
? *A. alboverrucosa*, id. ibid.
*Stellonia papposa*, Agassiz, Prodr. Monogr. Rad., Soc. Sc. Nat. Neufchâtel, vol. i. p. 191.
*Solaster papposa*, Forbes (1839), Mem. Werner. Soc. vol. viii. p. 121.
*Crossaster papposus*, Müller & Troschel (1840), Wiegmann's Archiv, iv. pt. 1, p. 183; Verrill, Proc. Boston Soc. Nat. Hist. vol. x. p. 334.

Coll. Feilden: Discovery Bay, 25 fms., hard bottom; Cape Fraser, 80 fms.; Franklin-Pierce Bay, 15 fms., bottom-temperature 29°·5 Fahr.

Coll. Hart: Franklin-Pierce Bay, 13–15 fms.

In the "Oversigt over Grönlands Echinodermer," Dr. Lütken records † that amongst the specimens of *C. papposus* which he had examined there occurred only one example of the ten-armed variety, those with twelve arms being the most common.

All the specimens of this collection are ten-armed, with the exception of one small and very young example having nine. Its greatest diameter is only 18 millims.

When compared with series of similar size from more temperate waters, the polar specimens are characterized by finer arms, fewer spine-clusters (bearing fewer but very much longer spinelets), the spine-clusters more widely separated from one another, and the ventral spaces almost naked. These points are so striking in some individuals that at first sight one is tempted to consider that we have here a well-marked variety of this almost cosmopolitan starfish. Careful

* The genus *Solaster* of Forbes included the two starfishes known as *Asterias endeca*, Linn., and *A. papposa*, Fabr. (Linck). The morphological differences of these forms are such, however, as to necessitate their being regarded as representatives of two distinct genera. Confining, therefore, Forbes's *Solaster* to his own type (*S. endeca*), Müller and Troschel's genus *Crossaster* (synonym of *Solaster*, Forbes, published a year later) is naturally assigned to the *Asterias papposa* type, Gray's designation *Polyaster* having been appropriated by Ehrenberg (*Polyasterias*) at an earlier date. The propriety of the above limitation was suggested by Dr. Lütken so far back as 1857. (*Cf.* Vidensk. Meddelelser, 1857, p. 35.)

† Vidensk. Meddelelser for 1857, p. 40.

study, however, of the series leads us to the conclusion that no sound distinction can be drawn; and we would offer as a suggestion explanatory of the divergence, that in these arctic forms of *Crossaster* premature phases are more slowly passed through, and that development of detail takes place in a different ratio to the body-growth from that which obtains under more favourable conditions of life.

The largest specimen obtained measures 93 millims. in diameter.

Brandt founded a species, *Asterias affinis*, upon a single specimen obtained in Behring Straits, but which, from the short description given, appears only to have been similar to the specimens before us; and, such being the case, the grounds are not sufficient to warrant the maintenance of his species. In all probability *A. alboverrucosa*, Brandt, is also identical.

A singular instance of the rapacity of this starfish may be here related. The disk of one of the large individuals from Discovery Bay being considerably distended, it was cut open; and the distention was found to result from the creature having gorged a young *Strongylocentrotus dröbachiensis*!, nothing but the clean calcareous plates of the test remaining*. In the stomach of another (very much smaller) specimen was found the shell of *Trochus olivaceus*, Brown (kindly determined by Dr. Gwyn Jeffreys).

### *Solaster endeca* (Linn.), Forbes.

*Asterias aspera*, O. F. Müller, Zool. Dan. Prodr. no. 2833.
*A. endeca*, Linnæus, Syst. Nat. (Gmel.), p. 3162.
*Stellonia endeca*, Agassiz, Prodr. Monog. Rad. p. 25.
*Solaster endeca*, Forbes, Mem. Werner. Soc. vol. viii. p. 121.

One young specimen, 14 millims. in greatest diameter, was dredged by Capt. Feilden in lat. 65° N., 26 miles from the Greenland coast, at a depth of 30 fathoms.

* The British members of the same species seem to be equally addicted to cannibalism. A few weeks ago one of the writers conveyed by railway a small *C. papposus* along with a specimen of *Astropecten*, in a jar of sea-water. On reaching home, after a journey of about three hours' duration, it was found that the asteroid had, according to their custom when irritated, thrown off portions of two of its arms, and that the *Crossaster* was busily gorging one of these pieces, fully the length of the diameter of its own disk! In the course of an hour the fragment had entirely disappeared. On being disturbed two or three hours afterwards, the *Crossaster* ejected the fleshless skeleton, if such a term may be employed.

In the British Museum is a specimen of *Astropecten hystrix*, Val., from the Mauritius, which had swallowed a large *Conus*, the latter extending even into one of the rays.

*Solaster furcifer*, v. Düben and Koren.

*Chætaster borealis*, v. Düben, Œfv. Kongl. Vet.-Akad. Förhandl. 1844, p. 113.

*Solaster furcifer*, v. Düben & Koren, Kongl. Vet.-Akad. Handl. 1844, p. 243, t. vi. f. 7–10.

Coll. Feilden: Cape Fraser, 80 fms.

A starfish of somewhat depressed form, having five broad flat arms. Proportion of disk-radius to length of arm 1 : 3. The calcareous network of the dorsal surface is very regular; and the spine-clusters or paxillæ, which spring from the intersections, form longitudinal series which run parallel to the median line of the ray; consequently only two or three of the middle series reach to the tip, although from fourteen to sixteen may be counted at the base of the arm. The paxillæ are very compact and have a stout rounded base, nearly twice as wide as high, bearing a crown of spinelets (about fifteen to twenty) in length about equal to the diameter of the base. The spinelets are, as a rule, flat; and from the angles of the apex, which is as broad as or broader than the base, proceed two small denticles, giving the appearance to the spinelet of a two-pronged fork; sometimes the spinelet is triangular, in which case there are three prongs. On the sides of the arms are two rows of large paxillæ or spine-clusters, the lower series being twice the breadth of the upper ones, and these themselves being much larger than the rest of the dorsal paxillæ just described. There are about twenty large marginal paxillæ from the arm-angle to the tip. Each interambulacral plate bears three equal-sized spines, running parallel to the furrow; and exterior to these are three or four spines webbed together into a "comb" and placed obliquely, or even in some cases at right angles, to the ambulacral series; whilst midway between the combs and the margin of the ray are three or four small spines (not sufficient to form a paxilla proper), which stand quite isolated and only extend about one third of the distance from the mouth to the tip of the ray. The madreporiform tubercle is excentral and situated at about one third the distance from the centre to the margin of the disk. The mouth-plates are large and broad, the marginal spines interlocking with one another.

Only two specimens were obtained by Captain Feilden, the largest of which measures 65 millims. in its greatest diameter, and 21 millims. across the disk; the arms at the base are 13 millims. broad.

*Pteraster militaris* (O. F. M.), Müller and Troschel.

*Asterias militaris*, O. F. Müller, Zool. Dan. tab. 131 (excl. textu).
*Asteriscus militaris*, Müller & Troschel, Syst. d. Asteriden, p. 44.
*Pteraster militaris*, Müller & Troschel, Syst. d. Asteriden, p. 128.

Coll. Hart: Dobbin Bay, 30 fms.

This starfish is readily distinguished from its congeners and the majority of other asteroids by the singular fin-like margin surrounding the arms, by the membranous skin which is spread over the upper surface, as well as by the series of webbed spines which stand, in transverse ranges like fans, by the side of the ambulacral furrow.

The form of the animal is pentagonal, the upper contour of the body high and arched, and the underside flat. Proportion of disk-radius to arm-radius 1 : 2. Each interambulacral plate is furnished with five or six long spines, which are connected together by a membrane into a webbed comb placed transversely to the ambulacral furrow. The outward spine of each comb is double the length of the others, and extends about half its length beyond the edge of the ray. These long spines are also united to one another by a connecting tissue, and thus form the fin-like fringe which surrounds the entire starfish. The ambulacral spines forming the fan-like comb are nearly equal in length, the middle ones being slightly longer.

The body-skeleton is composed of a calcareous network, from each of the cross joinings of which proceeds a spine-fasciculus bearing three or four spinelets. The whole dorsal surface of the animal is covered and concealed by a membranous tissue supported above the body, like a tent-cloth, by the spinelets, to the tips of which it is attached. A hollow infradermal cavity is thus formed. Neither the anus nor the madreporiform tubercle has any special aperture in this investing membrane; there is, however, a single large-sized opening, surrounded by a margin of spines, situated nearly over the dorso-central axis. In and out of this aperture Dr. Stimpson has observed currents of water passing, as in the cloaca of a *Holothuria*, from which fact he was led to regard the functions of the cavity as subservient to respiration *. MM. Koren and Danielssen, however, have pointed out that this intermediate space between the double dorsal skin fulfils a further and more important purpose by becoming a chamber in which the development of the eggs and embryos takes place †.

* Stimpson, "Marine Invertebrata of Grand Manan," p. 15, in Smithsonian Contributions, vol. vi.

† Koren and Danielssen, 'Fauna littoralis Norvegiæ,' Heft 2, p. 58.

Although our knowledge of marsupiation in Echinoderms has recently been largely augmented by the additional instances which Sir Wyville Thomson records as occurring in species from southern seas *, it is most interesting to find so special an adaptation for the purpose in this truly arctic asteroid.

Two specimens only were obtained, being dredged by Mr. Hart in Dobbin Bay. They measure about 60 millims. in their greatest diameter.

## Ophiuroidea.

### *Ophioglypha Sarsii* (Lütken), Lyman.

? *Asterias ophiura*, Dewhurst, Nat. Hist. Cetacea &c. Arctic Regions, p. 283, 1834.
*Ophiura texturata*, Forbes, pars (Append. Sutherland's Journal).
*Ophiolepis ciliata*, Sars, pars, Reise i Lofoten og Finmarken, p. 39; Stimpson, Invert. of Grand Manan, Smiths. Contrib. vi. p. 13.
*Ophiura aculeata*, Agassiz, Proc. Am. Acad. 1851, p. 269 (no descr.).
*O. coriacea*, Lütken, Vidensk. Meddelelser, Nov. 1854, p. 101.
*O. arctica* ?, id. ibid.
*O. Sarsii*, id. ibid., et Add. ad Hist. Ophiuridarum, p. 42.
*Ophioglypha Sarsii*, Lyman, Ill. Cat. Mus. Comp. Zool. Harvard, i. p. 41; Ljungman, Oph. Viv., Œfv. K. Vet.-Akad. Förh. 1866, p. 307.

Coll. Feilden: Floeberg Beach, 10 fms.; Discovery Bay, 25 fms.; Hayes Point.

An *Ophioglypha* with mouth-shields shield-shaped, longer than broad; length less than, or only equal to, their distance from the margin of the disk. Papillæ of the disk-incision about fifteen, and rather broad. Under arm-plates widely separate, of a very broad, short triangle-shape. Two tentacle-scales. No infrabrachial indentations. Spines rather long, equal in length to the side arm-plates.

This is the most northerly echinoderm brought home by the expedition, a fine specimen with a disk-diameter of 26 millims. having been taken by Capt. Feilden at the winter quarters of H.M.S. 'Alert,' in N. lat. 82° 27′. Other examples of this species were obtained at Discovery Bay, and among them one which is provided with remarkably long arm-spines, being in relative proportion fully twice the length of the spines generally occurring in *O. Sarsii*. In this individual the three spines of the sixth joint measure respectively 2·45 millims., 2·25 millims., 1·4 millim., the under arm-plate being ·7 millim. long, the arm-joint 1 millim., and the disk-diameter 15 millims. The remaining features of the specimen agree too closely with the characters of *O. Sarsii* (Lütk.), Lym.,

* Wyville Thomson, Journ. Linn. Soc. vol. xiii. p. 55.

to warrant its removal, in our opinion, from that species, even as a provisional variety.

In some cases great irregularity is exhibited in the mouth-papillæ, one abnormal example being particularly worthy of notice. In the *Ophioglyphæ* the innermost mouth-papilla generally stands immediately over the teeth, and might be easily mistaken for a tooth, being, in fact, affixed to the tooth-plate and not to the lateral plates. In *O. Sarsii*, as well as in other members of the genus, two additional papillæ are generally associated with it, one on either hand, and are in like manner borne by the ossicle upon which the teeth are placed.

In consequence of this arrangement it has long seemed probable to one of us that these subdental papillæ should be regarded as tooth-papillæ (of which they are in truth the homologues) rather than as mouth-papillæ, so-called, along with which they are commonly counted. One of the specimens taken in Discovery Bay throws considerable light upon this question.

In this individual the dental armature consists of four teeth regularly superposed, following upon which, and occupying the same breadth as a tooth, are three ossicles, which fit to one another wedgewise with sloping sides. Then come two which fit together and correspond in their shape with the irregularities of the upper and under tier, which latter consists of from three to five compact close-fitting papillæ; and these again are succeeded by three or four (in some rays five) moderately long, round-tipped, smaller papillæ, the whole forming a compact mass suggestive, in the highest degree, of ordinary tooth-papillæ, such as occur, for instance, in *Ophiothrix*; and yet in every detail, even to measurements, the specimen conforms to the diagnosis of *Ophioglypha Sarsii*. This individual has a disk-diameter of 22 millims.


Abnormal development of the dental armature in *O. Sarsii*.

Bearing in mind the tendency towards vertical reduplication of the mouth-papillæ in some genera, this cannot fail to be regarded as suggestive of the manner in which primitive tooth-papillæ may have been developed; nor is such an assumption

by any means extravagant when the great irregularity of these parts amongst arctic forms is taken into consideration.

### *Ophioglypha robusta* (Ayres), Lyman.

*Ophiolepis robusta*, Ayres, Proc. Boston Soc. Nat. Hist. iv. p. 134, 1851.
*Ophiura fasciculata*, Forbes, Append. Sutherland's Journal.
? *O. glacialis*, Forbes.
*O. squamosa*, Lütken, Vidensk. Meddelelser, Nov. 1854, et Add. ad Hist. Ophiuridarum, p. 46.
*Ophioglypha robusta*, Lyman, Ill. Cat. Mus. Comp. Zool. Harvard, i. p. 45; Ljungman, Oph. Viv., Œf. K. Vet.-Akad. Förh. 1866, p. 308.

Coll. Feilden: Discovery Bay, 25 fms., hard bottom Richardson Bay, 70 fms.; Hayes Point, 35 fms., bottom-temperature 29°·5, and also at 25 fms.; Franklin-Pierce Bay, 15 fms., bottom-temperature 25°·5.

Coll. Hart: "Winter quarters," Discovery Bay; Franklin-Pierce Bay, 13–15 fms., bottom stony.

An *Ophioglypha* with arms very finely tapering, and disk with regularly arranged scales of nearly equal size. Mouth-shields ovate shield-shaped, length less than, or at most only equal to, their breadth; length much less than the distance from the margin of the disk. Papillæ of the disk-incision very short and stout, often grouped. Under arm-plates broadly heart-shaped; one tentacle-scale.

This species was obtained at various stations, as indicated in the list of localities; and though neither the abundance nor the size of the specimens was remarkable, several good series were collected. The characters which have been regarded as "specific" are remarkably constant; and no essential difference can be traced between these arctic forms and specimens taken from the coast of Maine, U. S., with which they have been compared, excepting that in the northern Ophiurans the arm-spines are longer and somewhat more delicate, and that the outer margin of the under arm-plates is more arched and the reentering angle is far less developed, in certain species being even altogether untraceable. In some large examples the upper arm-plates are very markedly hexagonal.

Although this deviation is very constant, the foundation of "a variety" on the strength of such characters alone is hardly justifiable.

The arm-spines are moderately stout and tapering, the upper one being flattened and much larger than the others.

In most of the specimens under present consideration, the under arm-plates are well separated from one another by the side plates and do not overlap, although in one individual from Discovery Bay the first ten impinge distinctly in conse-

quence of their side arm-plates not meeting. This feature at the basal portion of the arm has been noted by Dr. Lütken as occurring in large specimens from Greenland, whilst he remarks at the same time that in none of the Danish examples examined by him do the under arm-plates touch.

The largest specimen was taken by Capt. Feilden in Franklin-Pierce Bay, the diameter of the disk (dried) being 10 millims.

### *Ophioglypha Stuwitzii* (Lütken), Lyman.

*Ophiura Stuwitzii*, Lütken, Vidensk. Meddel. 1857, p. 51, et Add. ad Hist. Oph. p. 49.
*Ophioglypha Stuwitzii*, Lyman, Ill. Cat. M. C. Z. Harvard, i. p. 51.

Two specimens were collected by Capt. Feilden in a dredging made in lat. 65° N., twenty-six miles from the Greenland coast, depth 30 fms.

### *Ophiocten sericeum* (Forbes), Ljungman.

*Ophiura sericea*, Forbes, Sutherland's Journ. &c. vol. ii. Append. p. ccxv.
? *O. abyssicola*, Forbes, Linn. Trans. vol. xix. p. 146.
*Ophiocten Kröyeri*, Lütken, Vidensk. Meddel. 1854, et Add. ad Hist. Ophiuridarum, p. 52; Lyman, Ill. Cat. M. C. Zool. i. p. 53.
*O. sericeum*, Ljungman, Œfv. K. Vet.-Akad. Förh. 1864, p. 360; 1866, p. 307.

Coll. Feilden: Discovery Bay, 25 fms., hard bottom; Cape Fraser, 80 fms.; Hayes Point, 35 fms., bottom-temperature 29°·5.

Coll. Hart: Discovery Bay, 15–20 fms., muddy bottom, also at 11 fms.; Franklin-Pierce Bay, 13–15 fms.

Disk very flat, with margin forming a sharp angle; covered with imbricating scales and a superficial squamo-granular layer, through which only portions of the radial shields and primary plates are visible. No disk-incisions, the disk forming a little arch over the base of the arms. A row of papillæ edges the genital slit, and passes over the arm along the disk-margin continuous with the series from the other side. The first three, or sometimes four, upper arm-plates at the base bear papillæ. Side arm-plates meet below, but not above. One tentacle-scale. Three arm-spines, arranged along the outer edge of the side arm-plate, the two upper spines being much the largest.

The main variation which we have noted in the arctic specimens of this species consists in the greater length of the arm-spines as compared with those of more southern examples. In a specimen 9·2 millims. in disk-diameter the length of the

upper arm-spine of the sixth joint was 1·85 millim. (in one case 2·3 millims.!); in another, with a diameter of disk of 8·5 millims., the same spine was 1·8 millim. long, three arm-joints in this individual being exactly 2 millims. In addition to the above, variations occur in the contour of the mouth-shields, and in the larger examples considerable irregularity is also found in the number and position of the mouth-papillæ. Amongst this collection are several specimens having a very decidedly pentagonal form of disk.

In our opinion, none of the above variations can be regarded as of greater morphological significance than growth-phases, or at most individual variations only. The largest specimen obtained was 11 millims. in disk-diameter.

### *Ophiopholis bellis* (Linck), Lyman.

*Scolopendroides bellis* (*scolopendrica*), Linck, De Stell. Marinis, p. 52.
*Asterias aculeata*, Müller, Zool. Dan. Pr. 2841; Zool. Dan. iii. p. 29, t. 99.
*Ophiura bellis*, Johnston, Mag. Nat. Hist. vol. viii. p. 595.
*Ophiolepis scolopendrica*, Müller & Troschel, Syst. d. Ast. p. 96.
*Ophiocoma bellis*, Forbes, Mem. Werner. Soc. vol. viii. p. 126; Hist. Brit. Starfishes, p. 53.
*Ophiopholis aculeata*, Lütken, Add. ad Hist. Oph. p. 60.
*O. bellis*, Lyman, Ill. Cat. M. C. Zool. Harvard, i. p. 96.

Coll. Feilden: lat. 65° N., 26 miles from Greenland coast, 30 fms.

### *Amphiura Holbölli*, Lütken*.

? *Ophiolepis Sundevalli*, Müller & Troschel (non Joh. Müller), Syst. d. Asteriden, p. 93.
*Amphiura Holbölli*, Lütken, Vid. Meddelelser, Nov. 1854, et Add. ad Hist. Ophiuridarum, p. 55; Lyman, Ill. Cat. Mus. Comp. Zool. i. p. 118.
*A. Sundevalli*, Ljungman, Oph. Viventia, Œfv. K. Vet.-Akad. Förh. 1866, p. 320.

Coll. Feilden: Franklin-Pierce Bay, 15 fms., bottom-temperature 29°·5 F.

An *Amphiura* with disk lobed; radial shields long and narrow; mouth-shields rounded; side mouth-shields large, subtriangular, with the sides reentering and angles rounded. Three pairs of mouth-papillæ, the middle ones placed higher than the others. Under arm-plates pentagonal. One tentacle-scale rounded; arm-spines 3–4.

Only a single specimen of *Amphiura* was taken; and this,

* So much confusion has arisen in consequence of uncertainty as to the identity of the original application of the appellation *O. Sundevalli*, that we prefer to retain Dr. Lütken's name, despite the example of certain recent writers to the contrary.

although it differs slightly from the type form in the relative measurements of certain points of detail, we have little hesitation in assigning to Dr. Lütken's species, the variations, in our opinion, not being of greater importance than such as we should regard as dependent on locality and conditions of life.

The arms are less broad, and take their origin in a more deeply reentering curve of the disk-margin, the radial shields are narrower, and the breadth of upper arm-plates in proportion to their length is less than in the type forms, as the following measurements will indicate:—Diameter of disk 8 millims.; radial shield, length 1·3 millim., breadth ·35 millim.; sixth upper arm-plate, length ·6 millim., breadth ·9 millim.

The spines are hollow cylinders, stout, blunt, and but slightly tapering; the upper spine on each side-plate tapers most. The first fifteen arm-joints bear four spines, the succeeding joints three only.

An interesting feature connected with this specimen is worthy of record, and is one which does not appear to have been noted by previous observers. The central spines are more or less flattened throughout their whole length; and at the tip compression has been carried to such a degree as to form a thin and somewhat expanded head—a peculiarity which is at once suggestive of a characteristic spine-appendage possessed by *A. filiformis*; and although in the specimen under notice this structural feature is by no means so fully developed as in that Ophiuran, it is still sufficiently marked to impress upon the mind the near relationship of the two species and the community of their descent—an hypothesis which is also further strengthened by the association of both the forms in more southern waters.

*Ophiacantha spinulosa*, Müller and Troschel.

? *Asterias bidentata*, Retzius, Diss. p. 33.
? *Ophiura fragilis*, Sabine in Append. Capt. Parry's Voyage.
? *Ophiocoma bidentata*, Müller & Troschel, Syst. d. Asteriden, p. 99.
*Ophiacantha spinulosa*, Müller & Troschel, Syst. d. Asteriden, p. 107.
*O. grœnlandica*, Müller & Troschel, Archiv für Naturgesch. 1844, p. 183.
*Ophiocoma arctica*, Müller & Troschel, Syst. d. Asteriden, p. 103.
*O. echinulata*, Forbes, Append. Sutherland's Journal.
*Ophiacantha spinulosa*, Lütken, Add. ad Hist. Ophiuridarum, p. 65; Lyman, Ill. Cat. Comp. Zool. i. p. 93; Ljungman, Oph. Viventia, Œfv. K. Vet.-Akad. Förh. 1866, p. 326.

Coll. Feilden: Discovery Bay, 25 fms., hard bottom; Cape Fraser, 80 fms.; Franklin-Pierce Bay, 15 fms. Temperature 29°·5 Fahr.

Coll. Hart: Franklin-Pierce Bay, 13–15 fms., bottom stony.

An *Ophiacantha* with disk covered with small round scales, each bearing a small short spinelet. Radial shields very obscure, sometimes quite covered. No disk-incision; and the dorsal membrane is prolonged over the base of the rays. Mouth-shields twice as broad as long, irregular ovate. Side mouth-shields long, narrow, arched and meeting within. Under arm-plates heptagonal or subheptagonal, breadth equal to length. Dorsal arm-plates triangular. Side arm-plates meeting above and below. Spines 7–8, long, thin, and denticulate, placed on a keel.

A greater number of this Ophiuran have been brought home by the expedition than of any other Echinoderm. The specimens range in size from those having a disk-diameter of 15 millims. to the young form of only 3 millims., and consequently form a most instructive series.

The variations dependent on growth are very considerable, so much so that isolated specimens taken from different stages in the series might easily be regarded as affording the types of distinct species.

Conclusive proof has been furnished by the material which we have had at our disposal that the *O. grönlandica*, M. & T., and the *O. arctica*, M. & T., are untenable species, as Dr. Lütken has already pointed out—and, further, that the characters which had hitherto been regarded as of specific value are not, as that eminent authority seems to infer, even variations such as can be regarded as dependent on distribution, but must be considered simply the phases incidental to age, together with ordinary individual variation.

Amongst the specimens procured by the naturalists of H.M.SS. 'Alert' and 'Discovery,' there are many presenting features developed in a manner which might be regarded as "ultraspecific" when compared with the previously recognized modifications of this "form." In the present state of knowledge, however, it seems preferable to comprehend them under *O. spinulosa* of Müller and Troschel, rather than to burden further the nomenclature with novel designations.

The mouth-shields and the under arm-plates in this species are subject to very considerable changes and variation, both in contour and in their relative proportions of length to breadth. In large and adult specimens the number and arrangement of the mouth-papillæ is also irregular; and not only is there a frequent increase in number in the ordinal horizontal series, but there is also a great tendency towards reduplication of certain papillæ in the vertical axis of the Ophiuran. This seems to arise from the longitudinal cleavage of preexisting papillæ.

In young individuals the spinelets of the disk are proportionally long, five or six times their own diameter, and present all the appearances of ordinary embryonic spines. During the process of growth, however, increase is made in thickness only, so that when maturity is attained, and the spinelets, along with the disk, are invested with the semitransparent leathery membrane of the body, the appearance is more that of short stumpy prominences than of actual spines—a deception which at first sight gives a totally different character to the Ophiurans.

*Astrophyton arcticum* (Leach), *fide* Smith.

*Gorgonocephalus arcticus*, Leach, 1819, Append. Sir J. Ross's Voyage.
*Astrophyton arcticum*, Smith, MS.

This Astrophyton was dredged off West Greenland by Mr. A. C. Horner, who accompanied Sir Allan Young in the 'Pandora,' at a depth of 600 fms. in Smith's Sound, lat. 78° 19′ N., long. 74° 30′ W. The present writers have not seen this specimen, and are indebted for the information to Mr. Edgar A. Smith, F.Z.S., of the British Museum, by whom it has been determined and referred to Leach's species. This is particularly interesting, as the original *Gorgonocephalus arcticus*, Leach, was obtained by Sir John Ross in Baffin's Bay, lat. 73° 37′ N., long. 77° 25′ W., at a depth of 800 fms. This was one of the earliest instances of a living organism being dredged from so great a depth.

Crinoidea.

*Antedon Eschrichtii* (Müller) and *Antedon celtica* (Barrett).

Coll. Feilden: Discovery Bay, 25 fms., bottom hard.

The *Comatulæ* were handed over to Dr. Carpenter for determination; and he has kindly informed us of the occurrence of the above-named species.

*Conclusions.*

It is clearly manifest that extreme caution should be exercised in drawing conclusions as to the general character of a fauna, on the basis of such scanty material as it is possible for a single expedition to furnish; and the authors feel that the great hesitation which they have in expressing definite opinion is fully warranted by the fact that considerable additions have recently been made to the Echinifauna of Northern-European waters, the details of which have not yet been published; and these investigations may, in all probability, have the result of going far towards rendering present

generalizations invalid. To mention one instance alone. Writing on the results of the 'Porcupine' dredgings in 1869, which have not yet been published in full, Sir Wyville Thomson, in his 'Depths of the Sea,' remarks :—Between Scotland and Færöe "we find . . . . . every one of the Echinoderms hitherto found on the coast of Scandinavia and Greenland, with the single exception, I believe, of *Ophioglypha Stuwitzii*, a shallow-water Greenland form, among the ophiurids, and of one or two holothurids, which have yet evaded us" (*l. c.* p. 43). It is tantalizing that Sir Wyville Thomson gives no record of the special Asteroids in his agreeably written narrative.

*Table showing the general Geographical Distribution of the various Species above mentioned; together with an Indication of those obtained by the previous Arctic Explorers, Captains Parry and Penny.*

| Parry. | Penny. | | Grinnell Land. | Greenland. | Arct. America. | Iceland. | Spitzbergen. | Scandinavia. | N. European. |
|---|---|---|---|---|---|---|---|---|---|
| | * | Cucumaria frondosa | .. | * | * | * | * | * | * |
| * | * | Strongylocentrotus dröbachiensis | * | * | * | * | * | * | * |
| ? | * | Asteracanthion grönlandicus | * | * | * | .. | * | .. | * |
| * | .. | —— polaris | .. | * | * | | | | |
| | | —— palæocrystallus | * | | | | | | |
| | | Stichaster albulus | * | * | * | * | * | .. | * |
| * | * | Crossaster papposus | * | * | * | * | * | * | * |
| | | Solaster endeca | .. | * | * | * | .. | * | * |
| | | —— furcifer | * | .. | .. | .. | .. | * | * |
| | | Pteraster militaris | * | * | * | .. | * | * | * |
| * | * | Ophioglypha Sarsii | * | * | * | *? | * | * | * |
| | * | —— robusta | * | * | * | * | * | * | * |
| | | —— Stuwitzii | .. | * | * | | | | |
| | * | Ophiocten sericeum | * | * | * | .. | * | .. | * |
| | | Ophiopholis bellis | .. | * | * | * | * | * | * |
| ? | ? | Amphiura Holbölli | * | * | *? | .. | * | ... | * |
| * | * | Ophiacantha spinulosa | * | * | * | * | * | * | * |
| | | Astrophyton arcticum† | .. | * | * | | | | |
| | | Antedon Eschrichtii | * | * | * | .. | *? | .. | * |
| | | —— celtica | * | ? | .. | .. | .. | .. | * |

The following were not obtained by this expedition:—

| | | |
|---|---|---|
| * | * | Ctenodiscus crispatus. |
| | * | Cucumaria Hyndmani = C. Korenii, *Ltk.* |
| | * | Chirodota brevis, *Huxley*, = Myriotrochus Rinkii, *Stp.* |
| | * | Ophiura glacialis, *Forbes.* |

† This was dredged by Sir John Ross in 1818.

Of these twenty Greenland and Grinnell-Land Echinoderms,

Fourteen are common to America and Europe;
Three are known as American and *not* European;
Two are known as European and *not* American;
One now first recorded from Grinnell Land only.

Analysis similarly shows that fourteen out of the twenty are Grinnell-Landic. And of these,

Eleven are common to America and Europe;
Two are known as European and *not* American;
One from Grinnell Land only.

Reasoning from present information, the writers are of opinion that the character of the Echinifauna under consideration is the effect of local modification acting upon a great polar distribution rather than of intercontinental emigration simply.

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## LVIII.—*Description of a new Species of Foraminifera* (Rotalia spiculotesta). By H. J. Carter, F.R.S. &c.

[Plate XVI.]

Ever since my description and illustrations of the structure of the shell of *Operculina arabica* were published ('Annals,' 1852, vol. x. p. 161, pl. iv.), I have felt certain that the spiculiform bodies therein described and figured were integral parts of the test, and not occasioned by any particular arrangement of its canal-system as stated by Dr. Carpenter, any more than the bricks of a house are dependent for their form on the position of the gas- and water-pipes. How far I was justified in making this assertion may be learnt from the following description of this new species of Foraminifera.

*Rotalia spiculotesta*, n. sp. (Pl. XVI. figs. 1–3.)

Parasitic, sessile, flat, subcircular, with irregular margin; colour dark brown in the centre, where the chambers are still filled with dried sarcode, becoming snow-white towards the margin, where they are more or less emptied by its contraction. Chambers commencing from a slightly raised, central, spherical, embryonal or primary cell, in regular spiral succession, soon becoming most irregular both in size and shape, when the spire can be no longer traced, as they descend outwards to a margin so irregularly undulating as to present in some parts narrow conical processes, while in others they are wide and round. Aperture not seen, but probably inferior, as none could be observed above. Test entirely composed of round,